The
Philippine Agriculturist

VOL. XIII, NO. 4 SEPTEMBER, 1924

THE FIRST LAGUNA PROVINCIAL FAIR[1]

WITH THREE PLATES AND FRONTISPIECE

The first Laguna Provincial Fair was held on the College of Agriculture campus during the last week of May. Unfortunately the attendance was disappointing owing to the heavy rains which fell almost every afternoon, but this did not detract from the general excellence of the exhibits. These for the most part were educational and appropriately the Colleges of Los Baños were represented by a large exhibit. A number of municipalities of Laguna displayed exhibits of their local industries and scenic attractions, and private firms were also represented.

MUNICIPAL PROVINCIAL EXHIBITS

The prominent feature of the Luisiana booth, which was prepared by the President of the town at his own expense, was the matting for which the town is noted, while the nearby Botocan falls were very realistically represented by a fall of abaca fibre surrounded by ferns and club-mosses. San Pablo built its booth round a miniature landscape of Lago Sampaloc. The basket-work and furniture from this town were particularly good. Calamba's most attractive item was a model fish trap with small fish swimming round and continually being caught and put outside again. The vegetables in this booth were striking on account of their size, especially one of the poisonous yams, *namé* (*Dioscorea hispida*). Calauan's pineapples were gargantuan. The motif of the Biñang exhibit was the chinela industry, wooden shoes performing the dual function, decoration and exhibition. Nagcarlan struck an original note by having its wares mounted on a motor truck, a minor but interesting item being a coconut producing three shoots instead of the customary one. Two booths represented the sugar planters, one being that of the Ca-Ba-Lag, the sugar planters association of Cavite, Batangas, and Laguna, and the other that of the Calamba Sugar Estate. The latter, in addition to the sugar cane exhibit, had a display of needlework, basketware and native hats, while mounted on the tower surmounting the building was a searchlight. The illumination of this tower was a prominent feature of the nocturnal panorama of the fair.

The needle-work of the Makiling Ladies' Club attracted a great deal of attention especially from the lady visitors.

---

1 General contribution from the College of Agriculture No. 116.

MACHINERY EXHIBITS

The principal feature of the Pacific Commercial Company's exhibit was a small irrigation outfit composed of a Worthington Volute Centrifugal pump having a 4-inch suction and a 3-inch discharge which was driven by a 10 H. P. Type "Y" Fairbanks-Morse Engine. This outfit was set in the Molawin Creek under the bridge at the entrance of the fair grounds, and was used to irrigate a small rice field which had been planted for this demonstration. The water was raised a distance of 56 feet and amply demonstrated to large and interested groups of spectators what can be done with a small outfit of this kind. This is the smallest of these outfits that the P. C. C. carries, but even this will irrigate 355 hectares of corn land or 8 to 10 hectares of rice land.

Next in point of interest was a Bandera No. 3 Rice Huller driven by a 6 H. P. Type "Z" horizontal engine burning kerosene. This hallter plant has a capacity of from 30 to 40 cavans of dry palay in a 12-hour working day.

Among their other exhibits were a Batangueño cultivator, Luzon Lagio plow, Negros plow, a Bradley corn planter, and several small corn mills both hand and power driven.

COLLEGE EXHIBITS

The exhibit of the Department of Botany contained specimens of some peculiar plants found on Mount Maquiling. *Hydnophytum* is a plant which harbors ants in its swollen base for protective purposes. *Rafflesia manillana*, a small cousin of the plant with the largest flower in the world, was attacking a vine, while *Olax imbricata*, a harmless-looking shrub was shown obtaining nourishment from the roots of another plant. Specimens of weed seeds showing their methods of dispersal were exhibited, and in a series of experiments it was proved that some weeds may have a beneficial effect on the soil. The department is investigating the possibilities of some of our local plants for apiculture, and pictures of a large number of flowers visited by bees were displayed. Weather graphs on the wall mutely defended the local climate which was sadly in need of defence at the time.

The Department of Agronomy under its several sections had a large and varied exhibit. A fine collection of begonias and ornamental aroids occupied one end of the College pavilion, and the Division of Plant Breeding had a collection of new varieties of ornamental *Hibiscus* bred at the College. In the latter exhibit were also included varieties of ornamental and economic plants produced by bud variation and by hybridization, one being a very promising disease-resistant variety of sugar cane. The Fibre and Oil Division was represented by samples of fibres produced at Los Baños with charts comparing the properties of the different varieties, and an abaca-stripping machine. Varieties of coconuts, including some huge specimens from San Ramon, Zamboanga, with coconut products, such as copra, dessicated coconut, oil, and wine, were exhibited with a picture of an ideal coconut plantation. Considerable interest was shown in the *oang*, larvæ and perfect insects of which occupied one corner of the exhibit.

The Philippines with a production of 323,000 tons this year stands fourteenth among the sugar-producing countries of the world, but its average yield is the lowest, being only one ton per acre. The problems which the agronomist faces when he tries to increase this yield are many. The sugar exhibit pointed out that the use of unselected seed points, late cultivation, poor attention, and

no rotation of crops are among the principal causes of the low yield. Fresh selected and unselected points were shown for contrast and it was stated that planting at an angle of 45° and at a depth of about 12 centimeters gives the best results. Dipping seed points in water at 60° for 10 minutes encourages germination and kills insect enemies.

The Pomology Division exhibit of fruits raised at the College attracted considerable attention because of the novelty of many of the species which thrive at the College, but are not yet known to the general public. Seeds of forage and food crops also formed a striking display. Seeds of varieties imported from other countries frequently fail to live up to their former reputation under Philippine conditions; such is the case with some maize varieties exhibited from Australia and America. Seeds of two hundred fifty varieties of rice were also on view, and gave an indication of the magnitude of the task of the man who wishes to attack the problem of their classification.

The Department of Plant Pathology demonstrated strikingly the enemies of the farmer in the fungal and bacterial worlds. Most of the crop plants of the Philippines were represented by specimens of unfortunate members attacked by plant parasites, some of which prevent the entry of our produce into other countries. Various fungicides and methods of applying them were on view, and the Department's latest bulletin, "Bud rot of Coconuts," by Doctor Ocfemia was distributed to those interested.

The Department of Rural Economics presented numerous interesting charts and diagrams. One was entitled "Watch him grow" and showed a number of Filipino lads in ascending stature proportionate to the increase of the population of the Islands. Another exhibited over two billion German marks once worth more pesos than ever were coined or printed but now having a value of less—much less—than a centavo. This exhibit was strikingly labelled "What happens when a nation plays politics with its gold reserves and its banks". From a large map of the Philippine Islands ribbons led to charts giving the details of the *per capita* agricultural production in each province. A huge sign bore the legend "There are 27,500,000 uncultivated hectares in the Philippines—why these imports?" From this an arrow led to a group of graphs on which the curves of food imports fairly rushed and jammed to climb over each other, thus illustrating a great and unnecessary loss of Philippine wealth.

The Department of Animal Husbandry had a large and interesting exhibit of animals and of animal by-products. Hassan, the newly-purchased grade Arabian stallion, and two native mares represented the equines. A good carabao bull, a work bullock, and a cow, together with a couple of hornless carabaos, a massive Indo-Chinese carabao bull were exhibited with a pair of Indian buffaloes. A cow, the offspring of the carabao and the Indian buffalo, attracted considerable attention. Native, Indian-Native, Hereford-Native, and Hereford cattle completed the exhibit of bovines. The Herefords are particularly interesting because they live at the College but have died in most places in the Islands to which they were shipped.

Pens of Berkshire, Poland China, Yorkshire, Duroc-Jersey, and Berk-Jala pigs illustrated the work being done in hog-raising. The Berk-Jala, a coming breed, was produced at the College by crossing Berkshire on a Jala-Jala foundation. An animal of good size, fast growing, prolific and very resistant to local

diseases was the result. A wild pig from Mount Maquiling and a two-legged pig attracted attention, though perhaps of a less serious nature.

Pens of poultry of Rhode Island Red, Barred Plymouth Rock, White Leghorn, Buff and White Cantonese and Native chickens were shown, as well as a brood of incubator-raised chicks being cared for by a capon.

By-products produced in the department included milk, butter, cheeses (Laguna, Cebu, and pimiento), and cured meats prepared without the aid of refrigeration.

The Department of Entomology marshalled a formidable array of insect enemies of Philippine cultivated and native plants, including such pests as the red spider, mealy bug, orange moth, and fruit fly. Included in this exhibit were specimens of snakes and other animals from Mount Maquiling. Civet cats, monkeys, hornbills, *bayawaks*, geckoes and house lizards are members of the fauna familiar to most people. The giant fresh water shrimps from Calamba, the crocodiles from Bay, and pythons and cobras from the mountain attracted considerable attention.

The exhibit of the Department of Rural Engineering was intensely practical and represented the more important phases of its work. The plows represented many different makes sold in the islands. Though the plow is the most fundamental tool of agriculture, we know little about the types best suited to Philippine conditions. The Rural Engineering Department therefore has undertaken the study of the subject, preliminary reports on the results of which were shown in the exhibit.

Commercial men realize the importance of the plow and a new type of Chattanooga plow and a new type of Luzon Lagio and Negros plow have been promised by two Manila firms. The hand rice thresher is something which is urgently needed and the Rural Engineering Department has undertaken the design of one which will be easily transferred from place to place.

A model farm septic tank easily and cheaply constructed was shown. Charts, maps, and pictures from the Irrigation Division of the Bureau of Public Works showing the remarkable work that has been accomplished in irrigation work, completed the exhibit.

The College of Veterinary Science presented a display of anatomical specimens, drugs, and instruments. Considerable interest was attracted by the collection of lesions of such diseases as rinderpest, swine plague, tumors, intestinal and fecal stones, kidney worm infestation in pigs, and rabies. One picture showed an extraordinary tumor weighing 19.5 kilograms taken from a carabao. Pictures of parasites, such as tapeworms, hookworms, and flukes were accompanied by preserved specimens taken from various domesticated animals and man.

A working model of a charcoal kiln was perhaps the most outstanding feature of the exhibit of the Forest School, and was a representation of the one at present in use at the school. Specimens of Philippine woods and of living orchids and ferns from various parts of the Islands were on exhibition with minor forest products, such as oils, gums, and resins.

THE WORK OF THE COLLEGE

The display in the Fair Grounds formed only part of the exhibit of the Los Baños Colleges and was intended primarily to indicate the type of investigatory

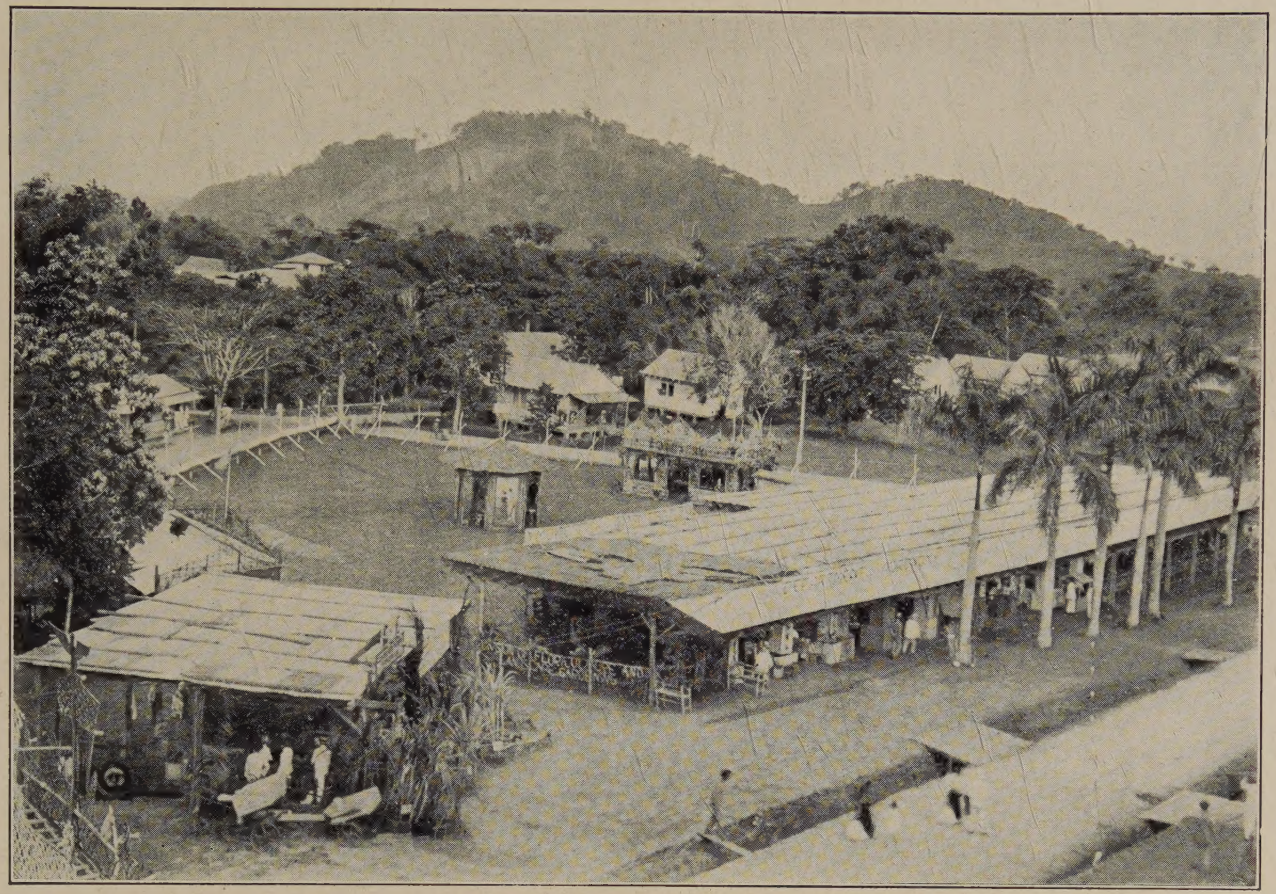

PLATE I

roots of many plants, and recent work in the department has shown that some of our common paddy weeds act in this way. Others, for example *Monochoria* and *Cyperus*, seem to have a beneficial action though this, of course, does not justify encouraging them in cultivation. *Olax imbricata*, a plant found in the virgin forest on Mount Maquiling, has been shown to be parasitic on the roots of forest trees, so that in any well managed forest this species should be destroyed.

An important section of the work being carried on is the study of the poison plants of the Islands. Naturally, the more remote parts of the Islands cannot be dealt with as fully as could be desired, but the help of students from outlying provinces is being enlisted by the department. There are numerous species of doubtful character in Laguna, and many are poisonous at one period and not at another. A common passion flower (*Passiflora fœtida*), for instance, was found to be poisonous at certain periods, though generally it is considered a good fodder plant. Such species are particularly dangerous because the farmer will usually not believe that his former friend could turn traitor. Other plants known to be poisonous are not commonly recognized. A few months ago a student almost lost his life through eating Physic nuts (*Jatropha curcas*) in mistake for peanuts. Still other plants are quite unknown to us as regards their poisonous properties. It was found that over two hundred of our common local species produce hydrocyanic acid, a swift and deadly poison. It was found that the stinging properties of the *cabo negro* fruit are due to an enzyme very similar to the pepsin of the stomach. Knowing this we can prescribe the antidote for injury by this plant. Any enzyme poison is efficacious because it destroys the cause of the trouble.

A knowledge of the poison plants is useful not only from the point of view of knowing which plants to avoid, but also from the fact that used in proper amount these plants may be extremely useful in the prevention of disease. *Dioscorea hispida*, a poisonous yam, has been used very successfully by Doctor Manresa of the College of Veterinary Science for the treatment of myasis.

The Department of Agronomy covers a very wide field of activity both in the scope of its teaching and of its investigational work. In fact the whole field of plant industry in the tropics is within the legitimate field of the department as organized. Since there is no single word in common use to cover this field, the term agronomy has been retained. For the sake of convenience the department is carried on in several divisions, such as Farm Management, Soils, Plant Breeding and several groups determined loosely by the practical relationships of the crops the culture of which is taught and investigated. One division is concerned chiefly with cereals, legumes, and fodder crops, another with coconuts and other oil producing plants, and with abaca and other fibers. Other divisions are engaged with tobacco, coffee, cacao, sugar cane, vegetables, etc.

The instructional work may be roughly divided into courses of study with the fundamentals, such as soils and their origin in relation to plants, the principles of crop production, and a general survey of the status of the principal Philippine crops, while the advanced courses enter into the details of the production of these different crops, such as sugar cane, corn, coconuts, abaca, rice, fruits, coffee, vegetables, etc. A separate course is given for each of these crops and these crop courses are elective, each student taking such as may be most closely related to the work which he expects to pursue. Then there are the courses on Genetics as related to the breeding of plants. Each Division also carries courses, such as

advanced Soils Studies or Advanced Pomology for students who have completed the undergraduate work. A more complete statement of these courses is presented in the University catalogue.

Each of the different divisions of the department is carrying on other activities chiefly of an investigational nature. For example, plant breeding investigations are being actively pursued and many very promising new varieties of plants have been developed and are under further study and test. One of the important features of this work has been the production by true seeds of new varieties of sugar cane. Several of these are very resistant to certain devastating diseases and these varieties are of sufficient promise that they are being tested not only at the College but by the large sugar cane plantations, and by the Philippine Sugar Centrals Agency; the department co-operating with these organizations. Doctor Mendiola, who is in charge of the plant breeding work, and his assistants are in close touch with the plant breeders of the world and are constantly on the lookout to learn of or to develop new and improved methods of technique in the production of cane seedlings or of the seedlings of other economic plants. Several new seedling varieties of sweet potatoes, of cassava, corn, pineapples and other fruits as well as ornamental plants including croton and hibiscus are under study, and varieties which may prove to be of great importance are being observed. Such investigations include not only the production of new seedlings but also the discovery, segregation and propagation of varieties which may have originated by natural means, such as seedless or near-seedless varieties of lanzons. Some such valuable sorts have been found and methods are being devised for their propagation by asexual or vegetative parts. Here the Division of Horticulture may be of assistance in devising adaptations of budding, grafting or marcottage for the successful propagation of these varieties. This merely illustrates how all the divisions together constitute one working and co-ordinated unit, all pursuing one general purpose.

Doctor Espino, who is in charge of the teaching and investigational work concerning oil and fiber producing plants, is conducting, with his assistants and students, valuable investigations relating to these different crops. He states there are at present under way comparative studies on some seventy varieties of abaca with respect to resistance to drought. Likewise, comparative studies of abaca varieties are being carried on with respect to various physical characters of the fibers with special emphasis upon the study of the tensile strength and microscopic structure of the fibers. The results from thirty-six varieties are now on hand and the study of eighteen more varieties is nearing completion. Many other phases of studies completed and of others in progress might be mentioned. Likewise investigations are being carried on to determine the fertilizer requirements of the plants concerned, particularly abaca and coconuts. While investigations concerning fiber plants center about abaca, the world renowned fiber of the Philippines, other possible important fibers suitable to different conditions and which may fit into the economic position of the Philippine Islands are not lost sight of. Maguey, sisal, roselle, jute, and many others are included. Likewise, although the work on oil bearing plants lays chief stress upon the coconut, studies and observations are made of the African oil palm (*Elaeis guineensis*), the native lumbang (*Aleurites moluccana*) and others. In all of these studies, students are conducted in excursions to regions in which coconuts and abaca are

grown and to the centers where copra, coconut oil, desiccated coconut, and lumbang or wood oil are being manufactured or prepared for market.

The Division of Soils has only recently been organized under the able direction of Doctor Pendleton, formerly Director of Agriculture for the Gwalior State in India. The investigational work is beginning with soil surveys and mapping as a basis for future work and is attracting the attention of those who are interested in the large development of great agricultural industries in these Islands.

Very important work in addition to instruction is being carried on by Doctor Vibar and his assistants in the study of rice, corn, and other cereals, also with forage crops and leguminous cover crops. Many of the more recently introduced grasses are under test and some have already demonstrated their superiority as sources of nutritious fodder for cattle, horses, and other farm stock. Many hundreds of varieties of rice have received attention and their adaptability to different conditions has been studied. One of the large problems which this division is undertaking is a search for varieties of leguminous crops which may be successfully used as a cover for the soil during the rainy season and as a source of mulching and of humus supply for the use of the land during the dry season.

Investigations in tobacco include the selection of strains from different hybrids produced at the College from imported varieties of tobacco crossed with native kinds. Likewise in connection with coffee, varieties are under test with a view of determining their value as a possible basis for a reviving coffee industry. For this purpose it is especially important that their resistance to the coffee rust disease should be studied, since it is this disease which destroyed the once flourishing coffee industry of the Philippines.

Investigations in sugar cane culture include, in addition to the breeding investigations already referred to, many experiments in the selection and methods of treatment of seed; varieties and their habits and adaptabilities; methods of planting; adaptability of implements; use of fertilizers and drainage and many other lines of experimental work.

Pomological investigations are being carried on in the Division of Horticulture under the immediate charge of the Head of the Department, in the trial of a very large number of native and introduced fruits and the testing of their adaptability to local conditions. The two most important new fruits receiving attention are the avocado and the cayenne variety of pineapple from Hawaii. Each of these gives promise of becoming the basis of a new industry in the Philippines. The avocado is the most nutritious of all fruits, tropical or otherwise, and forms a large part of the food supply in season in the countries in which it is extensively grown. It is demonstrating its adaptability to Philippine conditions and in years to come should add materially to the food supply. The Cayenne pineapple has demonstrated as fine production here as in Hawaii and there appears to be no good reason why a pineapple industry in the Philippines comparable to that of Hawaii should not be established. Investigations in this Division are also concerned with methods for the preservation of perishable seeds and other propagating material in transit. For example, lanzon seeds have been kept in good condition for a year, while normally they perish in a few weeks. Many different kinds of vegetables and ornamental plants are also being tested.

There are some important activities of the department, other than those which can be classified as instructional or investigational. One of the most

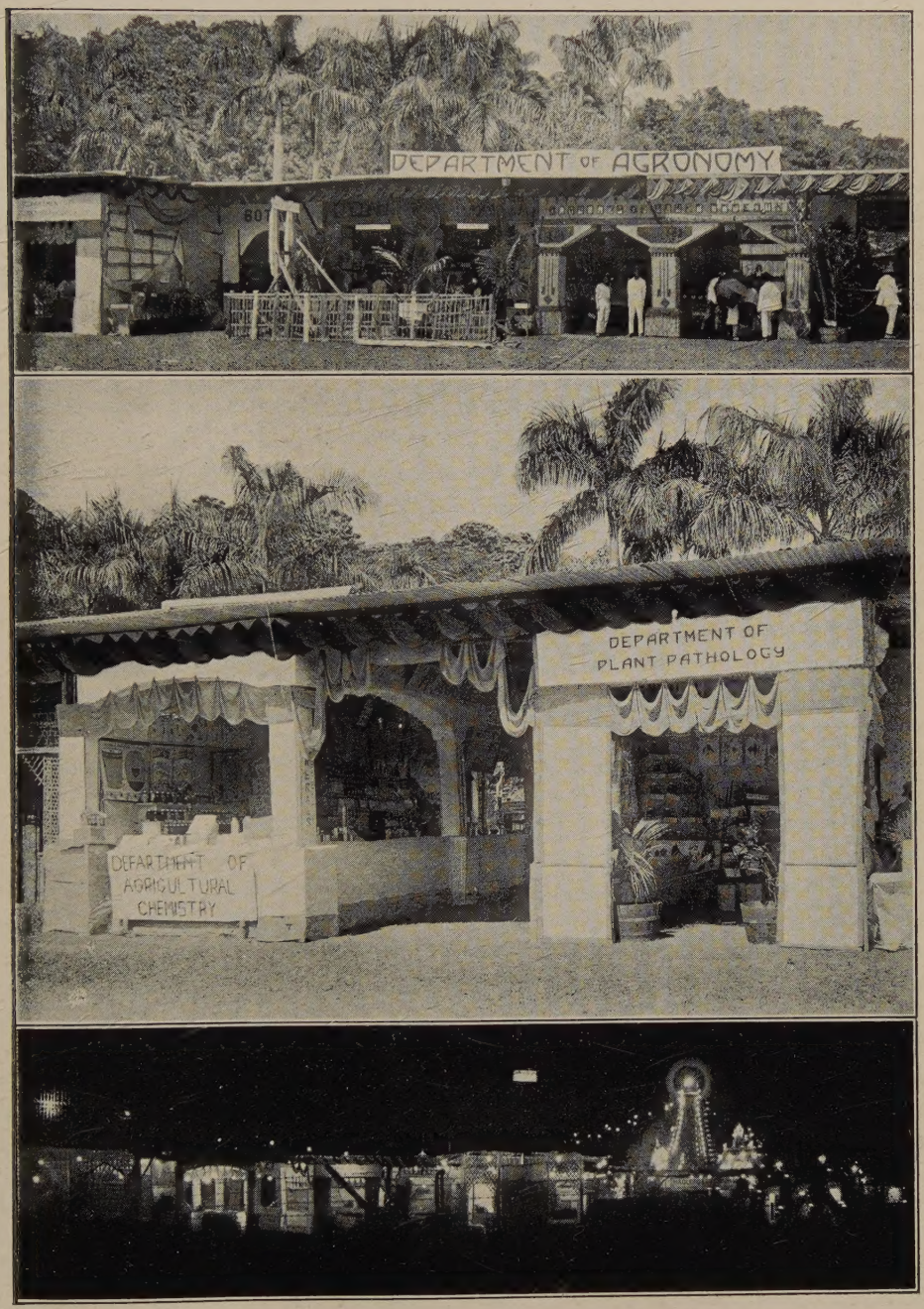
DEPARTMENT OF AGRONOMY
DEPARTMENT OF
PLANT PATHOLOGY
DEPARTMENT OF
AGRICULTURAL
CHEMISTRY

PLATE II

important of these is the work of the Farm Management Division which is achieving, in the face of many obstacles, the organization of a farm from the various small pieces of land that were purchased to form an Experiment Station and College Farm. Large quantities of grain and other animal feeds are grown and delivered to the Animal Husbandry Department where they are used in the production of meat, dairy and poultry products for sale. This work is under the supervision of Professor Raymundo who not only is familiar with local conditions but has had experience in California.

Other activities of the Department as a whole consist in the supervision of student labor; the operation of a salesroom where the minor products of the farm and gardens are offered to buyers; and the care of the large grounds of the College campus. The distribution of seeds or other propagating material of useful plants constitutes one of the very valuable services of the College to the public. By this means many newly introduced plants or those not yet well established in the Islands are being distributed to the farmers of the Philippines.

The work of the Department of Plant Pathology covers a wide field of plant diseases of the Philippines, with their cause and control. The principal investigations being carried out are as follows:

(1) *A new leaf disease of abaca.*—This leaf disease of abaca has not yet been officially reported. The taxonomic position of the fungus causing the disease, its life history in relation to the production of disease, conditions of abaca plants susceptible to infection, and environmental conditions affecting severity of disease are being studied both in the laboratory and in the field.

(2) *Phytophthora disease of eggplants.*—This disease was reported by Dr. Otto A. Reinking following its appearance in the Agronomy Gardens in 1918 as occurring in the Philippines but no work has ever been done on the disease in the Islands. A new species of Phytophthora causing disease of eggplants in Formosa has been described by K. Sawada as *P. melongenae*. The disease is said to be very destructive in Japan infecting all Japanese varieties of eggplants. The present investigation aims to find out the relationship of the fungus causing Phytophthora rot of eggplants in the Philippines and *P. melongenae* K. Sawada in Formosa. Work is also being carried out to study the behavior of the fungus in culture and in the field; its relation to other members of the family Solanaceae; the method of transmission and production of disease, and methods of control.

(3) *Determination of possible relationships of aecial and uredinial stages of certain common Philippine rusts.*—This work has been started to determine if any relation exists between aecial and uredinial stages of some of the common rusts both on cultivated plants and on weeds in the Philippines. Although, perhaps, a greater number of Philippine rusts follow the short-cycle life history (i. e. Uredinia to Uredinia) the presence of teliospores following the uredinial stage, and the occurrence of a number of aecial stages on a number of plants, appear a fertile field for investigation.

The need of a complete long-cycle life history of a Philippine rust is obvious. Until now the life history of *Puccinia graminis* Pers. is given to students in Plant Pathology. The students do not have any idea of a wheat and a barberry plant, which are the hosts of the disease.

(4) *Pineapple fruit rot.*—The object of this work is to study the cause and the conditions that favor the rotting of pineapples in the Department of Agron-

omy fields and storage house. Some of the symptoms of the rotting sent to the Department of Plant Pathology laboratory have been found identical with those described for Brown Rot disease of pineapple which has never been reported from the Philippines although it has been found to cause some loss in other countries.

(5) *Frothy fermentation of sugar cane juice.*—This problem was suggested by Dr. M. L. Roxas of the Department of Agricultural Chemistry after the outbreak of fermentation of cane juice in the U. P. Sugar Mill.

(6) *A comparative study of the anthracnose of abaca, avocado, banana, and mango.*—This work is a continuation of Agati's work on the "Banana Stem and Fruit Rot" with the aim to determine the relationships of the organisms causing anthracnose disease of fruits. The behavior of the organism, methods of disease production, conditions favoring the development of the disease, and control methods, are also being studied.

(7) *Aestivation of the citrus canker organism, methods of transmission, and control under Philippine conditions.*—Various sprays never before used in citrus canker control are showing promising results. Other diseases being studied include the blight of gabi (*Colocasia antiquorum* Schott.), anthracnose of eggplants, leaf spot of peanut, anthracnose of peppers, and the Sclerotium fruit rot of pepper, tomatoes, and other solanaceae.

The work of the Department of Agricultural Chemistry has been mostly in lines bearing on some Philippine industry. Studies of Philippine oil-bearing seeds and the constants of oils obtained from them and investigations along other agricultural chemistry lines have largely occupied the attention. A great portion of the work of the staff of the Division of Analytical Chemistry has been in connection with routine analysis of agricultural products submitted by different departments in connection with their research work. The division of sugar technology has been engaged in research of problems confronting the Philippine Sugar Industry, and has co-operated with the Agronomy Department in the analysis of sugar cane varieties under tests or of the varieties newly created by the Division of Plant Breeding. The Division of Biological Chemistry has been running tests of the biochemical properties of Philippine food and feeding stuff and is co-operating with the Department of Animal Husbandry in metabolism experiments. In the Division of Sugar Technology, automatic devices for sugar factories in connection with operations in the chemical control are being studied, with the view to designing new ones. One such apparatus for the automatic clarification of sugar cane juices has been devised and letters of patent applied for.

The published contributions of the Department have given the following results:

1. The possibilities of cassava as a source of alcohol have been studied and it has been shown that under suitable conditions industrial alcohol may be made from cassava as cheaply as from waste molasses.

2. Large profits may be obtained from the manufacture of starch from cassava under Los Baños conditions.

3. It has been demonstrated that the diet of the Filipino laborers around Los Baños is a limiting factor in their efficiency both as laborers and as members of the community.

4. From the point of view of agricultural chemistry, the most complete series of studies of copra meal ever carried out have been run.

5. Certain varieties of *Phaseoleus lunatus*, the lima bean, contain prussic acid in proportions that render them unsuitable for human consumption; methods of preparing the beans for the table that will remove the prussic acid have been indicated.

The following facts have been established:

6. That paayap is a good source of vitamin B.

7. That banana contains an appreciable amount of vitamin B, although to a less extent than paayap.

8. That papaya, likewise, contains vitamin B, but in even a smaller amount than banana.

9. That the greatest advantage of drying or evaporating mangoes over other means of preservation is the immense reduction in bulk of the fresh fruit, the average loss in weight being 87.0 per cent.

10. That mangoes, at the stage of proper ripeness, when peeled, quartered and sulphured for ½ hour, dry more quickly than when not sulphured, and give up their moisture in the air most rapidly in trays on cement floor. The average length of time in sun-drying mangoes under weather conditions, ⅓ sunny, ⅓ cloudy, and ⅓ rainy, is 33⅔ hours.

11. That the same kind of mangoes described in (2), but evaporated independently of weather conditions by using artificial heat at an average of 60°C., proved to be better in appearance and flavor than when sun dried. They were dried in approximately 17 hours less time than by sun-drying.

12. Canned mangoes with thin syrup retain their attractive natural color, sub-acid to sweet flavor, and semi-melting consistency, to a greater degree than by any other method of preservation tried.

13. The anti-scorbutic factor is not completely destroyed at 67°C. after 11 hours and 20 minutes drying; but at the same temperature after 14 hours and 20 minutes drying, it is almost completely destroyed. The vitamin content is not completely destroyed by the sun (31°C.) drying for 48 hours and the destructive effect of heat is to some extent lessened by sulphuring.

14. Canned mangoes retain their antiscorbutic property better in thin syrup boiled for 5 minutes than in medium syrups boiled for the same length of time.

15. When copra meal forms from 75 to 85 per cent of an otherwise complete ration, it is toxic and deleterious to guinea pigs and albino rats. Guinea pigs decrease in weight and rats become stunted in growth. Guinea pigs sicken on high percentages of copra meal and do not recover even when the diet is changed. Green guinea grass (*Panicum maximum*) as a supplement does not check the progress of the disease in guinea pigs. Tomato juice in sufficient amounts to prevent scurvy, does not prove beneficial. Rice bran extract containing enough vitamin B to promote usual growth fails either to restore rats to normal condition or to prevent emaciation, weakness, and stunted growth.

16. When present in small percentage in the ration (about 37 per cent) copra meal is promotive of health, vigor, growth and normal reproduction both of guinea pigs and rats. With high percentages of copra meal, albino rats show abnormal reproduction. Growth of young rats is to a large extent stunted.

Fatalities, general body emaciation, weakness, and other abnormalities in appearance are common.

17. Both guinea pigs and albino rats decline rapidly in weight on copra meal alone. In case of guinea pigs, death occurs in from two to four weeks.

18. When copra meal and green guinea grass are fed freely, guinea pigs take from 3 to 8 per cent of copra meal and from 92 to 97 per cent of grass. The young animals have a tendency to take more grass and less copra meal than have the older ones.

19. Both kinds of copra meal used, one high (12 per cent) the other low in oil content (5 per cent) produce similar deleterious effects which seem to show that the toxic property is not probably due to the oil content.

20. Seaweed can not support the life of guinea pigs even when supplemented with copra meal or artificial food mixture deficient in vitamin C, or guinea grass to about one third of the requirements of guinea pigs of the ordinary size.

21. A supposedly complete diet with 70 per cent of seaweeds greatly retards the growth of rats.

22. Supposedly complete food mixture with 20 per cent seaweed can support normal rate of growth of rats, but not for normal reproduction and for development and successful rearing of young.

23. The rate of the decline in weight of rats fed with seaweed is proportional to the iodine content of the latter.

24. Seaweed contains little vitamin B.

25. In general, guinea grass (fresh or dried) is better than cogon (*Imperata cylindrica*) as feed for guinea pigs. Guinea pigs on 100 per cent fresh guinea grass maintain constant body weights. Young, born of mothers fed on 100 per cent fresh guinea grass, are either stillborn or die within a few days after delivery.

26. Animals fed with 100 per cent fresh cogon quickly die of inanition.

27. A ration of five per cent copra meal, as supplement, plus nine per cent of either fresh guinea grass or fresh cogon is not conducive to successful reproduction.

28. A ration of 90 per cent fresh guinea grass plus 10 per cent copra meal is just as good for growth and reproduction as a ration of 85 per cent fresh cogon plus 15 per cent copra meal.

29. A diet of corn meal (5 to 15 per cent) plus fresh grass (95 to 85 per cent) induces growth but does not allow reproduction.

30. A ration of fresh grass 85 per cent, corn meal 10 per cent, and copra meal 5 per cent, is excellent for growth and reproduction.

31. Dried guinea grass or cogon supplemented with copra meal in varying proportions up to 40 per cent does not promote normal growth and reproduction, and does not protect the guinea pigs from scurvy.

32. In drying, cogon or guinea grass lose their vitamin C content.

The main problem being attacked by the Department of Animal Husbandry is the improvement of native domestic animals. The Philippine pig lacks many of the desirable characters of foreign breeds, and at the same time exhibits a resistance to parasites, such as kidney worms not possessed by imported animals. With a view to combining these two characters, a new breed is being evolved. This is the Berk-Jala, a cross between the susceptible Berkshire and a hardy

PLATE III

native breed from Jala-Jala. The work has been nine years in progress and shows great promise. The feeding value of banana stalks, molasses, edible canna tubers, and cassava; the use of camote as a forage; and the value of copra meal and shrimps as protein supplements for fattening barrows are also being studied. Special attention is being paid to diseases, especially to Ascaris and kidney worms. The department, being partly self-supporting, is also concerned with the commercial aspects of its activities. The cost of raising its animals is met by the sale of milk, meat, eggs, poultry, and live stock. The use of milk by the students is encouraged.

The growth and development of native cows, Herefords, Nellores and their grades receive attention from the Dairy Division. The Herefords do well under the ideal conditions at the College, and their failure elsewhere affords a lesson in the value of scientific treatment of animals.

The Cantonese fowl is being improved by selection and cross breeding, and desirable birds are distributed as they become available Special mention may be made of caponizing. Each student is required to be able to perform this operation, and demonstrations were made of the process during the week of the Fair. The study of nutrition of fowls is especially important in relation to egg production, and the value of rice, copra meal, and corn is at present being systematically determined. Poultry diseases are a serious problem, and those occurring round Los Baños have been dealt with in a general manner and are now being studied in detail.

ILLUSTRATIONS

FRONTISPIECE

The College of Agriculture in 1921 as seen from the air.

PLATE I

Panoramic view of the College exhibit at the fair.

PLATE II

Upper and middle figures: Departmental exhibits.
Lower figure: The fair by night. (Photograph by C. R. del Rosario.)

PLATE III

Portion of the Agronomy exhibit.

NOTES ON SOME ECONOMIC PLANT DISEASES NEW IN THE PHILIPPINE ISLANDS[1]

By G. O. Ocfemia

Of the Department of Plant Pathology

Many plants cultivated in the Philippine Islands are grown also in other countries having either tropical or subtropical climate; these Philippine plants, many of them, have diseases in common with those of their own kind grown in other countries. The causal agents of these diseases probably have been disseminated either with the crop during introduction or with packing or bedding materials used in the transportation of manufactured products. On account of climatic conditions the prevalence and severity of these diseases vary in different localities. Sometimes diseases which are serious in other countries do not appear in the Philippines in a degree of severity to attract attention. For example, *Piricularia Oryzae* Cav. the blast fungus of rice (*Oryza sativa* L.) has been reported as the most destructive of the rice fungi in Italy, Japan, Russia, and other rice-growing countries. Although the fungus has been collected on rice in the Philippines its ravages have not been serious enough to attract attention thus far. A serious outbreak of diseases sometimes follows prolonged dry seasons, because plants without artificial irrigation are usually much weakened. The outbreak of severe infections takes place often after the first rains as the surrounding conditions are favorable for the optimum and rapid development of organisms causing diseases. After the first rains the host plants start on their rapid growth but the process is slower, comparatively, than that of the disease-causing organism. On account of this handicap plants are overcome by their parasites and serious outbreaks of diseases may follow. Thus, the anthracnose of pepper recently noted and collected had a serious outbreak after the first heavy rains when the pepper plants were just beginning to respond to the presence of moisture in the soil. Since the anthracnose fungus is comparatively faster in its development than the host it overcame the slowly recovering pepper with destructive results.

During the past few months diseases of plants which have been reported in other countries have been collected on the farm of the College of Agriculture at Los Baños, Philippines. Some of these diseases have been described recently in other countries, while others have been known many years, but no mention of any of them has been made in reports in the Philippines. It is probable that the organisms causing these diseases have been present in the Islands from the time that their host plants were grown but their effects on crops have never been sufficiently serious to be noticeable.

ANTHRACNOSE OF MANGO

The anthracnose of mango (*Mangifera indica* L.) was first noted and collected by the writer on December 5, 1923. Young mango leaves and twigs in

[1] Experiment Station contribution No. 240.

the mango nursery rows of the College of Agriculture were very seriously affected by the anthracnose. The disease is shown by the presence of numerous oval to oblong, brown spots varying in size from very minute lesions to those with diameters two millimeters or more in length. The lesions are abundant on the young and tender leaves and twigs which are brownish or purplish in color. Many of the spots grow together forming larger ones and causing distortion of the host tissues. The spots are sometimes inconspicuous when they are young on account of the color of young mango leaves and twigs.

If affected young leaves and twigs of mango are placed in the damp chamber a rapid irregular browning starting from the spots takes place. The browning covers entire leaves and twigs in two to four days. The browning is water-soaked at the border and moist on the surface. Before the moisture on the surface of the brown areas dries out pinkish tufts of fungus fruiting bodies appear in great numbers.

The pinkish tufts of fungus material have been found to consist of acervuli of a species of Gloeosporium. The fungus has been isolated by single-spore method, cultivated on common artificial media, and tested for pathogenicity. The results obtained in inoculation experiments are positive. Whether the Gloeosporium causing anthracnose of mango in the Philippines is identical to *G. mangiferae* Henn. or to the other species described on this plant in other countries is yet to be determined in the work now under way in the Department of Plant Pathology. The work now in progress aims to determine the exact taxonomic position of this fungus, to study the production of the perfect stage, to determine its economic importance and its life history in relation to the production of disease in order to consider methods for its control.

ANTHRACNOSE OF ABACA

The anthracnose of abaca (*Musa textilis* Née) in the Philippines occurs on leaves of seedlings and of grown plants as well as on fruits. The symptoms are very much like those on banana (*Musa sapientum* L.) reported by Agati in 1922[2] except that the lesions on the abaca are smaller. The disease was first collected from abaca seedlings in the nursery grown by Doctor Mendiola of the Plant Breeding Division, Department of Agronomy, a year ago. Although the banana and abaca are two distinct species yet they seem so closely related that, so far as known, parasitic fungi on abaca may be found on the banana also.

The work on the Gloeosporium causing the banana, abaca, avocado (*Persea gratissima* Gaertn.) and mango anthracnoses is being carried out by the Department of Plant Pathology to find out the relationship of the forms of Gloeosporium found on these four important crops of the Islands.

ANTHRACNOSE OF PEPPER

The anthracnose of pepper (*Capsicum annuum* L.) was first collected by the writer on June 2, 1924, after the first hard rains following the dry season of this year. At the time the specimens were collected actual counts of diseased fruits showed that from 50 to 75 per cent of the crop was infected and was absolutely useless. The symptoms of the disease of the pepper agree closely with the de-

---

[2] Agati, Julian A. Banana stem and fruit rot. Philippine Agriculturist, **10**: 411-422. 1922

scriptions of the anthracnose of pepper caused by *Colletotrichum nigrum* E. and H. which has been reported in eastern United States.

MOSAIC OF PECHAY

Specimens of pechay, or Chinese cabbage (*Brassica pekinensis* (Lour.) Skeels) attacked by mosaic disease were collected by the writer from the Department of Agronomy Olericulture gardens on February 23, 1924. Specimens of this disease show the characteristic mottling of the leaves. In advanced cases the leaves which are affected do not develop to normal size. Specimens of mosaiced pechay may be found in the museum collection of diseases of Philippine economic plants in the Department of Plant Pathology. Mosaic of Chinese cabbage, mustard, and turnip was reported by Schultz[3] in 1921 as occurring in the United States. No mention of the occurrence of mosaic on Cruciferæ has been made from the Philippines heretofore.

MOSAIC OF BALSAM

Specimens of balsam (*Impatiens balsamina* L.) infected with mosaic disease were collected by the writer in a flower garden in Los Baños, Laguna, in December, 1923. The characteristic leaf mottling and the dwarfing of plants were noted. Balsams affected by the disease did not produce any flower although the unaffected plants of the same age fruited abundantly.

FRUIT ROTS OF PINEAPPLE

On June 12, 1924, Professor Higgins of the Department of Agronomy sent specimens of diseased fruits of pineapple (*Ananas comosus* (L.) Merr. (*A. sativus* Shultes f.)) to the Department of Plant Pathology for the determination of the cause of the rotting. Some of the fruits had the incipient stages of the rot due to a Thielaviopsis resembling *T. paradoxa*[4,5]. Infected ripe fruits showed more or less water-soaked appearance. The affected pineapples were somewhat softer than those which were sound. In the young stages of the disease the fruits were watery and liquid would squirt when the water-soaked regions were pressed between the hands. Bits of the interior tissues of the pineapple when plated on sterile corn meal in petri dishes produced a grayish black fungus growth. The fungus growth sporulates abundantly producing chains of dark ovoid to oblong macro-conidia and chains of colorless micro-conidia of nearly the same shape. In advanced cases the grayish black fungus fructifications become evident on the stem-ends of the fruits and on the surface of the wounds in a few days. The sporulation on the wounds on the fruits is followed by general rotting of the entire fruit.

Other fruits of pineapple sent for examination had the brown rot infection. The infection of the brown rot is not general like the Thielaviopsis rot, but it is localized on a few of the eyes. The infection also suggests that entry of the fungus takes place through the flower probably during the blooming season or

---

3 Schultz, E. S. A transmissible mosaic disease of Chinese cabbage, mustard, and turnip. **Journal of Agricultural Research. 22:** 173-178. pl. B. col. 22-24, 1921.

4 Larsen, L. D. Diseases of the pineapple. Report of work of the Experiment Station of the Hawaiian Sugar Planters' Association, Bulletin 10: 9-70. *Fig. 1-26.* 1910.

5 Patterson, Flora W., Charles, Vera K., and Veihmeyer, Frank J. Some fungus diseases of economic importance. II.—Pineapple rot caused by Thielaviopsis paradoxa. United States Department of Agriculture Bureau of Plant Industry Bulletin 171: 15-38. *Pl. 2-8, fig. 1-3.* 1910.

immediately after the petals fall. From specimens thus far received for examination no external indications of brown rot infection may be seen on the fruit. The infection of the disease cannot be seen until the peel is removed or when the fruit is cut open. Isolations made by plating portions of pineapple fruits with brown rot gave a fungus the identity of which is being studied.

Inoculation experiments on pineapples using both the pineapple fungus Thielaviopsis and the fungus isolated from brown rot produced positive results. Inoculation of sugar cane (*Saccharum officinarum* L.) with Thielaviopsis from the pineapple gave the typical symptoms of pineapple disease. The writer, assisted by Mr. E. F. Roldan, is now conducting experiments to determine the species of the fungus causing pineapple rot and brown rot in the Philippines. Studies are also being carried out to determine (a) the method of transmission and infection; and (b) the stage of the development of the pineapple when infection under field conditions in the Philippines takes place.

SCLEROTIUM ROTS OF PLANTS

In addition to the various economic hosts reported by Reinking[6] as hosts for Sclerotium of the *rolfsii* group, several others including peppers and tomatoes (*Lycopersicum esculentum* Mill.) were collected after the first rains at the beginning of June, 1924. The collection of new host plants of Sclerotium of the *rolfsii* group tends to show that this soil fungus is very cosmopolitan.

---

[6] Reinking, Otto A. Host index of diseases of economic plants in the Philippines. Philippine Agriculturist, 8: 38-54. 1919.

MASS SELECTION IN PHILIPPINE RICE FIELDS[1]

By Zosimo T. Montemayor

WITH ONE PLATE

INTRODUCTION

"Mass selection" is briefly defined as the process of selecting the best plants in a field, mixing the seeds thereof, and then planting them *en masse* (1). This method of improvement was one of the earliest methods employed in the improvement of small grains, such as wheat, oats, and barley. The best work on mass selection was, according to Carleton (1), that of Rimpau. In Rimpau's work, which was begun in 1867, rye was used, and through repeated mass selection he was able to segregate ultimately a variety of rye with short square spikes from long stiff culms with large spikes. At the breeding station in Svalöf (1), mass selection was the first method of selection used, and it has never been abandoned as a means of improving cereals. By this method it is claimed that desirable strains of wheat, barley, and oats were developed.

In rice, mass selection has been carried out on an extensive scale in the Philippines since the year 1915. During 1915, 1916, and 1917 the Philippine Bureau of Agriculture launched a campaign for greater food production; and among the recommendations was the mass selection of rice seeds.

The present work involves mass selection in ordinary Philippine rice fields (lowland), one *caingin*[2], and in one field planted one plant to the hill. As a method of selection, mass selection is one of the simplest. It can easily be followed by the farmers because the process is not very tedious, nor is it difficult and complicated. However, the desired results are realized only slowly even under the most favorable conditions (2).

REVIEW OF IMPORTANT WORK IN MASS SELECTION IN RICE

The literature on mass selection in rice is very limited; in the work that has been done practically none has been performed with sufficient control.

It was once claimed (3) that by "rigorous selection" the yield of mass selected rice will more than double the yield of non-selected rice. The following statements (4) quoted from the *Philippine Farmer* show one method of mass-selection:

> Go into the field just before harvest and search for good *palay* plants. When such a plant is found, cut off all good heads, leaving a sufficient length of straw for convenient handling. Be very careful to collect heads which are as nearly alike as possible.

These directions show how easy mass-selection may be made. Just what a "good plant" is, is explained thus (4):

> A good plant is one which produces five or more stalks, each bearing a head of medium size, each head containing plump, well matured kernels. All heads of the plant should be borne at a uniform height above the ground.

Mendiola (2) contends that the effect of mass selection alone in rice in the Philippines must be limited. He thinks that in the Philippines proper mass

---

1 Thesis presented for graduation from the College of Agriculture, No. 188; Experiment Station contribution, No. 241. Prepared in the Department of Agronomy under the direction of Dr. Nemesio B. Mendiola.

2 *Caingin* is a newly cleared forest area (usually burned over), planted to upland rice for one or more seasons.

selection in the field is impossible, and that, if it is to be done at all under local conditions, additional selection will be needed to obtain good results. Digging up, separation of the stool, and selection of the desirable plants should follow the mass selection of the plants in the field. These selected plants should be freed of the soil that sticks to the roots so as to allow examination of the number of plants in each hill and the ultimate separation of the individuals. Once the plants are separated, the final selection, which is called in this case laboratory selection, may be performed. Laboratory selection, Mendiola claims, is necessary because of the fact that in the native method of planting rice under both the upland and the lowland conditions, there is usually more than one seedling planted to the hill. Those who do not find the present system of planting a hindrance to proper mass selection maintain that even if the hill be taken as a unit, a "good hill" can not be good unless the plants thereof are good (4). The same investigator maintains that it is impossible to tell the merits of individual plants when there is more than one in a hill, for several plants in a hill may appear better than one good plant in another hill. Should Mendiola's objection hold true, it would be impractical to perform mass selection properly in such a field as the *caingin* where in a hill there may be from 10 to 40 plants.

Table I is a compilation of some of the results obtained in the mass selection work in the different rice regions of Laguna. These results were published in different issues of the *Philippine Farmer* (5):

TABLE I.—*Some results of mass selection work in rice in different parts of Laguna.*

Name of co-operator.	Year.	Variety of rice used.	Yield of selected seed.	Yield of supposed control.	Increase in yield due to mass selection
			cavans	*cavans*	*cavans*
Mrs. G. Rubi....	1916	Roxas	160.00	—	—
Mrs. G. Rubi....	1916	Dinagat	70.00	25.00	45.00
Lope Vergan.....	1916	Dinagat	57.00	25.00	32.00
Isaac Swayan....	1916	Kinanda	62.00	24.00	38.00
Llasigi.....	1916	Dinagat	65.50	27.00	38.50
Babira.....	1917	Macan	50.00	40.00	10.00
R. Dios.....	1916	Macan	57.00	38.00	19.00
Baragnio.....	1916	Magsalit	65.00	40.00	15.00
O. Rubi.....	1917	Binangbang	57.00	40.00	17.00
P. Ramos.....	1916	Magsalit	62.00	35.00	27.00
A. Moldes.....	1917	Macan Cumpol	135.00	35.00	100.00
T. Malana.....	1916	Inantipolo	85.00	—	—
T. Malana.....	1916	Dinagat	72.00	23.00	49.00
Bu. of Agriculture[a]	.....	.....	125.00	15.00	110.00

a An experiment by the Bureau published in an Editorial. *The Philippine Farmer*, **1**: p. 4. 1915.

The following quotation, also from the *Philippine Farmer* (6), gives additional information:

> Mr. Venancio Velasco, a rice co-operator of Santa Lucia, Ilocos Sur, harvested his plot of Capiguid rice in January with a resulting yield of 70 cavans for the area which was exactly a hectare. His neighbors harvested only 30 cavans from each hectare of their land. This yield was the outcome of the selected seeds and proper cultural method.

OBJECTS OF THE PRESENT WORK

This work had for its objects the following: (a) To determine the difference in yield between mass-selected seed and non-selected seed (control) of rice

from Philippine rice fields; (b) To determine the difference in yield between mass-selected seed and non-selected seed from a field of rice planted one plant in a hill; and (c) To find, whether or not, mass selection in the field planted singly is better than mass selection in the ordinary fields where there is more than one seedling in the hill.

TIME AND PLACE OF THE PRESENT WORK

This work was performed in 1922, 1923, and 1924. The mass-selected and control seeds of the different varieties used were obtained from the fields of the Agronomy Department, College of Agriculture, from a *caingin* in Los Baños, and from 11 rice fields in Alaminos, Pangasinan Province.

MATERIALS AND METHODS

In this work both upland and lowland rice varieties were used. Of the upland, variety Inacopañga; and of the lowland, varieties Azucena, Balbalayang, Cochon, Marintec, Mestizo, Payapay, Daluson, Makabiag, Kinastila, and Lumbang were the ones used.

In the cultural tests, two large rice paddies and one *caingin* in Los Baños were used. The paddies were treated as uniformly as possible. In the two preceding years these fields had been planted to Para grass.

HOW MASS SELECTION WAS PERFORMED

In the mass selection work, the directions given by the Bureau of Agriculture was followed with some modifications to suit the requirements of the experiment. To carry out a check for every culture, the field where mass selection was made was first divided into two lots. From one lot, the plants that were "good," according to the Bureau of Agriculture standard, were selected. These plants had five or more stalks to the hill, were free from disease, with heads uniform in height above the ground, and also regular in size. Plants that were near dikes or that were isolated were not selected. From the other lot all of the plants were harvested. Then a fair sample of seed equal in amount to the mass-selected seed was set aside. The selected seed was labeled "mass-selected" and the unselected seed was labeled "control". Both kinds were dried thoroughly, put in separate bags, and stored side by side.

CULTURAL TESTS

In January, 1923, one planting was made, but this was largely destroyed by rice borers. A culture on an extensive scale carried out in Alaminos, Pangasinan, also failed because it was washed out by the flood and hard storm which occurred in November, 1923. Another planting was made in the College in June, 1923. The seeds were germinated in seed beds, one bed for the mass-selected seed and another for the control. There were 20 seed lots in all, two lots for each of the ten varieties.

While the seedlings were developing, the field for final planting was prepared according to the native method of preparing lowland rice fields. When the field was ready, it was divided into 20 lots, 18 of which were 24 square meters in area, and two, 18 square meters. The lots were rectangular in form and were separated by paths 50 centimeters wide. In planting these lots, student labor was used. The seedlings grown from the mass-selected seeds and the control seeds were planted in lots side by side. Two methods of planting rice were employed;

one was the one-plant-to-the-hill method and the other was the native method, which allows more than one seedling in a hill. The varieties planted by the native method were Azucena, Balbalayang, Cochon, Payapay, Marintec, and Mestizo. Those that were planted one-plant-to-the-hill were Daluson, Kinastila, Lumbang, and Makabiag. The latter varieties were also planted by the native method, but the cultures failed owing to rice borers, as mentioned above. The planting was finished July 14, 1923.

In both the native and the one plant-to-the-hill plantings, the cost of planting a hectare was determined by taking the average time needed to plant 24 square meters. This time divided by 24 and then multiplied by 10,000 will give the time needed to plant one hectare. The time (number) to plant one hectare multiplied by the rate of labor per hour will give the cost of planting one hectare. The cost of mass-selecting one cavan of seed from ordinary fields and from fields planted singly was also determined by taking the time spent in mass-selecting one liter of seed. This time multiplied by 75 will give the time required to mass-select one cavan of seed. Multiplying this by the rate of labor per hour will give the cost of mass-selecting one cavan of seed.

The cultures were harvested lot by lot. The harvests were labeled as "mass-selected" and as "control". They were threshed separately, dried in the sunshine thoroughly, and then the yield was determined.

EXPERIMENTS AND RESULTS

YIELDS OF MASS-SELECTED AND CONTROL SEEDS FROM ORDINARY RICE FIELDS

The mass-selected seed of the variety Azucena yielded about 34.6 per cent more than the yield of the control. This increase is equivalent to about 20 cavans a hectare. Of the variety Payapay, the corresponding increase was 25 per cent, equivalent to about 11.1 cavans a hectare; of the varieties Balbalayang and Mestizo, the increases were only 2.0 and 4.2 per cent, or about one cavan and 2.8 cavans a hectare, respectively. All these results are given in Table II.

TABLE II.—*Yields of mass-selected and control seeds from ordinary rice fields.*

Variety names.	Kinds of seeds.	Area planted.	Yields.			Relative yields.[a]
			Actual.	Per Ha.	Diff.	
		sq. m.	*liters*	*cavans*	*cavans*	*per cent*
Azucena[b]	Selected	24	14.0	77.7	+20.0	134.6
Azucena	Control	24	10.4	57.7	—	100.0
Payapay	Selected	24	10.0	55.5	+11.1	125.0
Payapay	Control	24	8.0	44.4	—	100.0
Mestizo	Selected	24	12.5	69.4	+ 2.8	104.2
Mestizo	Control	24	12.0	66.6	—	100.0
Balbalayang	Selected	24	9.2	51.0	+ 1.0	102.0
Balbalayang	Control	24	9.0	50.0	—	100.0
Marintec	Selected	24	3.0	16.6	— 8.4	66.4
Marintec	Control	24	4.5	25.0	—	100.0
Cochon	Selected	24	5.0	27.6	— 4.0	87.3
Cochon	Control	24	5.7	31.6	—	100.0
Inacopañga	Selected	30	6.5	28.8	— 3.6	88.8
Inacopñga	Control	30	7.3	32.4	—	100.0

[a] Control is given 100 per cent value for comparison.

[b] Plot near the border of the field; unavoidable owing to lack of labor and land.

Unlike the varieties Azucena, Payapay, Mestizo, and Balbalayang, the control for the varieties Cochon, Marintec, and Inacopañga[3] yielded more than the plantings of mass-selected seeds. The difference in favor of the non-selected seeds was 16.7 per cent for the variety Cochon; 33.6 per cent for Marintec; and 11.2 per cent for Inacopañga.

It is important to note here that the variety Marintec lodged in the field, and was badly attacked by rats. This is the cause of the yields of both the control and the mass-selected seeds being very low.

YIELDS OF THE MASS-SELECTED AND CONTROL SEEDS FROM THE FIELD PLANTED SINGLY

The mass-selected seeds in all cases yielded more than the controls. The increases in yields of the mass-selected seeds are: For the variety Daluson 43 per cent; for Makabiag 100 per cent; for Kinastila 25.5 per cent; and for Lumbang 50 per cent. These increases in yield to the hectare are correspondingly equivalent to 1.67 cavans for the variety Daluson; 1.67 cavans for the variety Makabiag; 13.89 cavans for the variety Kinastila; and 37.04 cavans for the variety Lumbang. However, the varieties Daluson and Makabiag were damaged by rice bugs, *Leptocorisa acuta* Thunberg, and for this reason no reliance should be placed on the results with these two varieties, although such results were in harmony with those obtained with the others. The yields of one-plant-to-the-hill cultures are presented in Table III.

TABLE III.—*Yields of mass-selected and control seeds from fields planted one plant to the hill.*

Variety names.	Kinds of seeds.	Area planted.	Yield.			Relative yield.
			Actual.	Per Ha.	Diff.	
		sq. m.	*liters*	*cavans*	*cavans*	*per cent*
Daluson	Selected	24	1.0	5.55	+ 1.67	143.0
Daluson	Control	24	0.7	3.88	—	100.0
Makabiag	Selected	24	0.6	3.33	+ 1.67	200.0
Makabiag	Control	24	0.3	1.66	—	100.0
Kinastila	Selected	24	12.3	68.33	+13.89	125.5
Kinastila	Control	24	9.8	54.44	—	100.0
Lumbang	Selected	18	15.0	111.11	+37.04	150.0
Lumbang	Control	18	10.0	74.07	—	100.0

ADAPTABILITY OF AN ORDINARY RICE FIELD AND A FIELD PLANTED ONE-PLANT-TO-THE-HILL TO PROPER MASS SELECTION

To find out which field, the ordinary rice field or the one-plant-to-the-hill, is the better adapted for mass selection in rice, it was necessary to determine: (a) The extra expenses that would be involved in mass-selecting one cavan of seeds in both fields; (b) The expenses incurred in planting one hectare of both fields; and (c) The size of the one-plant-to-the-hill field and the ordinary field that will produce one cavan of mass-selected seed. Other conditions were assumed to be equal.

In a field planted one-plant-to-the-hill, it was found that planting cost ₱11.78 a hectare under the rate of student labor in the College of Agriculture. The ordinary method of planting cost ₱7.08 a hectare under the same labor

[3] A caingin rice culture.

conditions as that of the one-plant-to-the-hill planting (Tables IV and V). The extra labor needed in the one-plant-to-the-hill planting was due to the separation of the seedlings. All other work employed, such as pulling up the seedlings, washing and trimming, required practically the same time for both methods.

In mass selection work, it was faster to make the selection in a field planted one-plant-to-the-hill than to mass-select in an ordinary field. In this work it was found that it cost ₱6.15 to mass-select one cavan of seed from 4,000 square meters of ordinary rice field, and ₱2.06 to mass-select one cavan of seed from 2,483 square meters of the one-plant-to-the-hill field.

TABLE IV.—*Rate of planting by the native method.*

Number of trial.	Area planted.	Time spent in planting.		Av. time spent in planting.		Time to plant one Ha.	Cost of planting one Ha.
	sq. m.	*min.*	*sec.*	*min.*	*sec.*	*hours*	*pesos*
First.....	24	7	15				
Second....	24	8	5				
Third.....	24	10	3	8	31	59	7.08
Fourth....	24	11	15				
Fifth.....	24	5	—				

TABLE V.—*Rate of planting rice by the one-plant-to-the-hill method.*

Number of trial.	Area planted.	Time spent in planting.		Av. time spent in planting.		Time to plant one Ha.	Cost of planting one Ha.
	sq. m.	*min.*	*sec.*	*min.*	*sec.*	*hours*	*pesos*
First.....	24	11	40				
Second....	24	14	5				
Third.....	24	16	30	14	9	98.2	11.78
Fourth....	24	17	5				
Fifth.....	24	15	6				
Sixth.....	24	10	30				

TABLE VI.—*Time and cost to mass-select; and area to produce one cavan of mass-selected seed.*

Kinds of field.	Area of field.	Amount of seed selected.	Time spent.	Area to give one cavan.	Time to mass-select. one cavan.	Cost of selecting one cavan.
	sq. m.	*liters*	*min.*	*sq. m.*	*hours*	*pesos*
One-plant-to-the-hill....	96	2.9	40	2,483	17.2	2.06
Ordinary.....	240	4.5	185	4,000	51.3	6.15

The cost of planting of both the ordinary and the one-plant-to-the-hill methods seems to be rather low. This low cost was due mainly to the kind of labor employed. Student laborers are much faster in planting rice than most wage laborers, and also, the unit area planted was 24 square meters and no allowance for rest and renewal of seedlings was made. However, from the results obtained, we can readily compare the extra time needed in planting by the one-plant-to-the-hill method and the ordinary method.

DISCUSSION OF RESULTS

YIELDS OF MASS-SELECTED AND CONTROL SEEDS FROM ORDINARY RICE FIELDS

As shown in Table II, the yield of mass-selected seed of the variety Azucena is more than the yield of the control by 34.6 per cent. It should, however, be noted that the plot planted with the mass-selected seed of this variety was at the border of the field (a condition which was unavoidable), so that the plants were probably under more favorable conditions for development than the control. Granting that there was an increase in the yield of the mass-selected seed over that of the control, the difference due to selection alone would not have been as great as 34.6 per cent.

While it may be admitted that it was the extraordinary condition that was responsible for the much greater yield of the mass-selected seed of the variety Azucena, the same condition did not exist with the other varieties. With the variety Payapay, as shown in Table II, the mass-selected seed yielded 25 per cent more than the control. The varieties Mestizo and Balbalayang were apparently not much affected by mass selection. These varieties were probably more homogeneous than the varieties Azucena and Payapay so that the effect of selection was comparatively small. With the varieties Marintec, Cochon, and Inacopañga the non-selected seeds actually yielded more than the mass-selected seeds. The different and unfavorable results of mass selection as given above might be explained on the ground held by Mendiola (2), that it is impossible to tell the merits of individual plants when there is more than one in a hill. Under such conditions selection would become a hit-or-miss method of improvement. As was found, hills that were good in appearance and consequently likely to be estimated as better than any other hill had, upon examination, more than one plant in a hill (Plate I, fig. 1). For this reason in a field of this kind, actual selection of only the best plants is impossible.

YIELDS OF MASS-SELECTED AND CONTROL SEEDS FROM ONE-PLANT-TO-THE-HILL FIELDS

Unlike the seeds selected from the ordinary field (Table II), the selected seed from the one-plant-to-the-hill fields yielded more than the controls. As shown in Table III, the increases for the varieties Daluson and Makabiag were 43 per cent and 100 per cent respectively. The crops, however, were abnormal because they were severely infested by rice bugs, *Leptocorisa acuta* Thunberg, hence a fair conclusion can not be drawn. Nevertheless, the results from these cultures conform with those from Kinastila and Lumbang varieties. As stated above the fields from which the seeds were selected were planted one-plant-to-the-hill. In these fields the plants had much more chance to develop fully than when there are several plants in a single hill. In view of this condition, the good plants, if the characters that make them good are hereditary, will naturally surpass the poorer ones in the course of their development, so that when mass selection is made the merits of the individuals can be observed. Naturally the best plants are selected for seed and the poorer ones are left to be harvested for general use.

COMPARATIVE ADAPTABILITY TO MASS SELECTION IN AN ORDINARY FIELD AND IN A FIELD PLANTED ONE-PLANT-TO-THE-HILL

It was found in India (7) that transplanting rice at the rate of one seedling in a hill gave greater yield for a three-year test than transplanting two, three or

more seedlings in a hill. But our Filipino farmers object to planting only one seedling in a hill on the ground that conditions are too uncertain to warrant good results, for, if the newly planted seedlings die, replanting one seedling to the hill would be more troublesome than with the ordinary planting. Whether or not this objection of the farmers is based on sound judgment remains to be determined.

Rate of planting.—It was found, as shown in Tables IV and V, that the one-plant-to-the-hill planting cost more to the hectare than the ordinary planting because it took more time to cover a hectare. The difference was due to separation of the bundled seedlings into single plants before sticking them into the soil. Nevertheless, it was observed that if the seedlings were reasonably large, the extra expense for this item could be reduced. The labor and time spent in pulling up, washing, and trimming the seedlings are practically the same for the single planting and the ordinary planting.

Mass selection.—Another important point for consideration is the time spent in mass selection operation in the two kinds of fields. It was found that it took comparatively much less time to mass-select a liter of seed from a field planted singly than it did to mass-select the same amount of seed from an ordinary field. If the field had been large enough this work could have been extended. However, given the results as shown in Table VI it would require about 17 hours, or a labor expense of two pesos and six centavos to mass-select one cavan of seed from a field singly planted, as compared with 51 hours, or a labor expense of six pesos and fifteen centavos for the ordinary field. This difference was mainly due to the conditions of the plants in the field. That is, the plants in the field planted singly were more uniform than the plants in the ordinary field. The non-uniformity of the plants in the field planted by ordinary method was because there were several plants in the hill (see Fig. 2, Nos. 1, 2, and 3). The growth and behavior of the plants were found to differ. No two rice plants are exactly alike. On the other hand, in the one-plant-to-the-hill planting all of the stools in the hill were of the same origin and resembled one another in most characters.

Rate of seeding.—The rate of seeding was not determined by the writer. However, Franzuelas (8), reported that it would require eight gantas of seed to plant a hectare if the transplanting were done at the rate of one-plant-to-the-hill. Comparing this amount with one cavan of seed required to plant a hectare by the ordinary method, and assuming that distancing is practically the same, it is evident that much seed could be saved by planting singly.

Amount of mass-selected seed to the hectare.—It was found, as shown in Table VI, that four cavans of mass-selected seed can be obtained from a hectare of the field planted singly and two and one-half cavans from the ordinary field. This difference is because, as mentioned above, the plants in a field planted one-plant-to-the-hill lend themselves more readily to selection than those planted in the ordinary field.

SUMMARY OF CONCLUSIONS

1. Seed, mass-selected in the Philippine rice fields (where planting allows several seedlings in a hill), did not always give increased yield.

2. Seed, mass-selected in a field planted one-plant-to-the-hill, gave increased yield when this seed was planted one-plant-to-the-hill.

3. Mass-selecting a given amount of seed in a field planted one-plant-to-the-hill required much shorter time than mass-selecting the same amount of seed from an ordinary field.

4. A hectare of one-plant-to-the-hill field would produce more mass-selected seed (if mass selection were done properly) than the same area of the ordinary field where there are several plants in a hill.

BIBLIOGRAPHY

(1) Carleton, M. A. The small grains. 699 pp. New York, 1920.
(2) Mendiola, N. B. Methods of breeding tropical crops. 260 pp. College of Agriculture, Los Baños, P. I. 1921. (Mimeographed.)
(3) Apostol, Silverio. Our rice problem. The Philippine Farmer **4**: p. 73. 1917.
(4) Anonymous. Field selection of seed palay. The Philippine Farmer **3**: 77-78. 1917.
(5) Anonymous. Some noteworthy results of seed selection in the province of Laguna. The Philippine Farmer **3**: p. 84. 1917.
(6) Anonymous. Field notes, demonstration and extension. The Philippine Farmer **3**: p. 35. 1917.
(7) Smith, F. Autumn rice or aman paddy experiment at Bardawan in Bengal. The Agricultural Journal of India **2**: 334-348. 1907.
(8) Franzuelas, Candido. Methods of planting small plots of palay in Catarman, Samar. The Philippine Farmer **3**: p. 99. 1917.

ILLUSTRATIONS

Plate I

Figure 1.

No. 1. A hill showing the effect of several plants in a hill. The panicles are not uniform.

Nos. 2 and 3. Hills perfectly "good" in appearance. Ordinarily, these are considered good plants to mass-select.

Nos. 4 and 5. Hills perfectly good; containing only one plant in every hill.

Figure 2.

No. 1. Same as No. 1 in Figure 1 showing the individual plants in the hill after laboratory separation.

Nos. 2 and 3. What were considered "good" plants in Figure 1 (Nos. 2 and 3) after performing the examination of the number of plants in the hills.

Nos. 4 and 5. Nos. 4 and 5 in Figure 1 showing that there was actually only one plant in each hill.

Figure 1

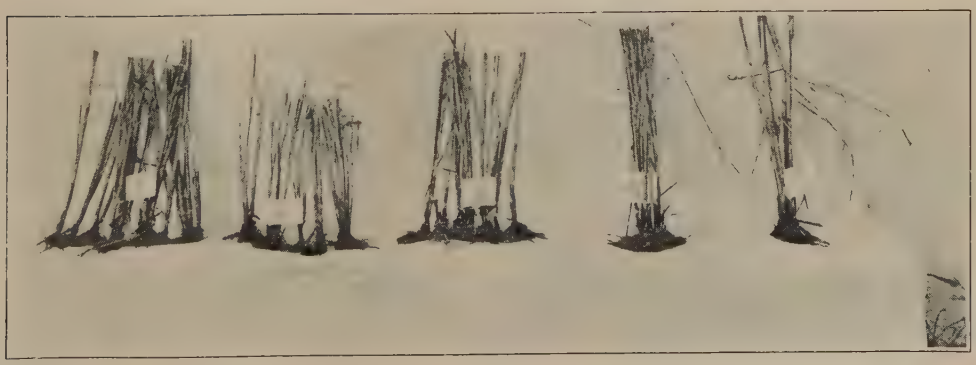

Figure 2

PLATE I

ABSTRACT[1]

A comparative study of milk, snail, and copra meal and their different combinations as supplement to corn for growing chicks. BENITO MONCERATE. (*Thesis presented for graduation from the College of Agriculture, No. 189; Experiment Station contribution No. 242*). The supplements employed were milk, copra meal, and snails. They were added, either alone or in combination, to the basal ration, which was ground corn.

The different mixtures employed were the following:—

Experiment I.—Equal parts by weight of the basal ration and the supplement (1:1).

Experiment II.—One part of the basal ration and two parts by weight of the supplement (1:2).

Experiment III.—One part of the basal ration and three parts by weight of the supplement (1:3).

The author gave the following conclusions:

1. As supplement to ground corn for growing chicks, milk was superior to either copra meal or snail.

2. Milk alone as supplement was better than the mixtures: copra meal-milk; snail-milk; copra meal-snail; or milk-snail-copra meal.

3. The order of the relative efficiency of the various mixtures for supporting growth of chicks was:

First, milk supplement produced a weekly average gain of 41.34 grams.

Second, milk-copra meal and snail supplement produced an average weekly gain in growth of 33.1 grams.

Third, copra meal-milk supplement produced an average weekly growth of 30.81 grams.

Fourth, milk and snail supplement produced an average weekly growth of 30.38 grams.

Fifth, copra meal and snail supplement produced an average weekly growth of 29.64 grams.

Sixth, copra meal supplement produced an average weekly growth of 29.28 grams.

Seventh, snail supplement produced an average weekly growth of 25.12 grams.

4. The relative mortality of the chicks in the different lots was:

First, copra meal, 33 per cent.
Second, copra meal-milk-snail, 34 per cent.
Third, milk, 38 per cent.
Fourth, copra meal-milk, 42 per cent.
Fifth, copra meal-snail, 46 per cent.
Sixth, milk-snail, 48.00 per cent.
Seventh, snail, 68 per cent.

5. Relative vigor of the chicks in the different lots:

First, milk.
Second, copra meal.
Third, copra meal-snail.

No appreciable difference in vigor could be noted in the other lots.

—*Abstract by Delfin P. Divinagracia.*

[1] Abstract prepared as part of required theme work in English 101, College of Agriculture.

EXCHANGE NOTES

"The rat population of the United States is more than 110,000,000", R. N. Nabours, head of the zoology department of the college (Kansas State Agricultural College) stated recently. Careful estimates made by the members of the zoology department of the college and the United States biological survey place the minimum cost of the maintenance of a rat at two dollars per annum. . . . . .

"People contribute this $220,000,000 and more each year to the support of rats that carry deathly diseases, eat with the rats out of common containers, listen to their gnawing, scratching, and squeaks, smell them, taste them, with a complacency which belies the high state of civilization we claim," declared Professor Nabours.

—The *Kansas Industrialist.*

It has been found that hens prefer flat roosts to round ones. It is apparently easier for them to balance themselves on the flat roost. In case of a wide and narrow roost, the hen will use the narrow roost to better advantage than the wide one. She will not stand flat-footed on the roost if she can help it but will move to the edge so that she can hook her toes over the edge of the roost.

—The *Cyprus Agricultural Journal.*

In the Department of Agriculture (U.S.A.) we have more than 2,500 scientific men, a large number of them serving directly the dairy industry and many others serving in related fields. I believe that is the largest group of scientific men that can be found anywhere gathered together in one place throughout the world.

Let me give you one illustration of how the research of the man of science may be applied in a field seemingly far removed from the field in which he is working. Many years ago one of the scientists in the Department of Agriculture made the fundamental discovery that the transmission of the Texas fever of cattle was due to a parasite. That discovery made possible the discovery of the transmission of yellow fever in man, and of other diseases now brought under control. . . . . .

I would like to bring to this platform the various groups of people who go to make up our national life, and not only ours but the national life of all countries, and I would like to call their attention to this fact—that here is a group of people from the field and farm and the scientific laboratories, gathered together not to consider hours of work or how to limit production, or how they may scheme and conspire for their own selfish benefit, but how they may make production more efficient, how they may make the commodity in which they are interested more healthful and get it to the consumer in a cheaper way, how they may perfect the processes all along the line. I would like to say to these various groups: Get the spirit of service which breathes out of every gathering of this kind and go thou and do likewise. Then the troubles of this old world would disappear like the

mists of a Washington morning under the warming sun, and we would have co-operation. We would have peace on earth and good-will among men.—U. S. SECRETARY OF AGRICULTURE, Address of welcome, The World's Dairy Congress.

—*World Agriculture.*

In connection with the method of steeping turnip seed in turpentine before sowing, with the object of warding off attacks of the "turnip-fly," a question has been raised as to the effect of such steeping on the germination capacity of the seed. A series of experiments recently carried out at the Department's seed-testing station showed that turnip-seed suffered no diminution in germination after soaking for seven days at a temperature of 65° to 70° F. in pure turpentine. As about twelve hours' steeping is the practice usually followed, a good margin of safety is thus indicated. After seven days the vitality of the seed in the test began to be affected, a loss of 5 per cent to 10 per cent in germination capacity resulting from steeping for fourteen days.

—*New Zealand Journal of Agriculture.*

The important point to realize from the educational aspect is that intelligence whether it be considered within or outside of the College, (Imperial College of Agriculture, Trinidad) is of at least three distinct psychological types. There is Abstract Intelligence, or the ability to deal successfully with symbols, as in mathematics or writing; Mechanical Intelligence, or the ability to deal successfully with machinery; and Social Intelligence, or the ability to deal successfully with people. These three types are now definitely recognized in psychology and have nothing to do with "knowledge" *per se:* they are types of *ability.* One of the difficulties attendant on agricultural pursuits not only involve the application of these three types, but also probably a fourth and hitherto inadequately unrecognized type; namely, Biological Intelligence, or the ability to deal successfully with plants and animals.

It is with Social Intelligence that we ought to be concerned, and with its development, not only within, but also outside of the College. This type of intelligence aims at inculcating a fairly normal emotional state, ability to make ethical discriminations, to take an interest in others, and to form proper moral concepts. These are just as necessary for success and happiness in agriculture and industry generally, as the possession of a fair degree of abstract, biological or mechanical intelligence.

—*Tropical Agriculture.*

Californians have no immediate cause for alarm, but during May (1924) it was found that the heavy infestation of aphids on citrus which certain areas of Florida have been experiencing is due, not to the old "melon aphis," as had been supposed, but to a new species. The melon attacks citrus more or less regularly in the spring, sometimes badly curling up the young growth on a few small trees, but usually is soon controlled by its parasites. Until recently it was supposed that the trouble in many parts of the state was due to this insect, but it now appears that it is not the melon aphis. The new insect differs from the melon aphis in being of bright green color in the young stages, and in the large number of winged individuals. The winged characteristic of so many individuals has caused a rapid spread of the insect. The new insect is present generally throughout the southern part of the citrus belt.

—*California Cultivator.*

COLLEGE AND ALUMNI NOTES

Doctor Brown, Director of Bureau of Science and Doctor Merchant formerly with the College of Veterinary Science and Medicine were recent visitors on the Campus.

Colonel Vans Agnew, Veterinarian, United States Army, spent several days at the College recently, the guest of Professor Hester. Colonel Vans Agnew was investigating the possibilities of establishing in Batangas Province a station for breeding horses for use of United States troops in the Islands.

The Los Baños Biological Club held the first meeting of the college year on July 31. The following papers were presented:

Is an accessory food factor present in *uray babae* (*Amaranthus* sp.)?
Prepared by Dr. F. O. Santos and Mr. Esteban Collado.
Read by Doctor Santos.

Pineapples produced at the College of Agriculture.
By Dr. N. B. Mendiola.

Maceration and bleaching of bones for anatomical specimens.
By Dr. G. San Agustin.

According to a letter received by Doctor Ocfemia from Professor L. R. Jones of the University of Wisconsin, Dr. Otto A. Reinking is back in the Department of Plant Pathology of the University working on the Fusarium of banana and other plants. Doctor Reinking will be joined by Doctor Wollenweber from Germany and Doctor Sherbakoff from Tennessee, who, with some members of the Department of Plant Pathology of the University, including Miss Helen Johann, will spend some weeks in a conference over the further monographing of the Fusarium group.

Luis J. Dangilan, '24, writes that he is teaching tropical agriculture and arithmetic in the seventh grade, English composition and literature in the First Year, and biology and animal husbandy in the Second Year in the Nueva Vizcaya Farm School. Messrs. Dadufalsa, '22, and Rayrao, '24, are with him on the same faculty.

In addition to his teaching work, Mr. Dangilan is in charge of the cattle ranch of the school.

Mr. Leon G. Gonzalez, M. S. '22, sailed on July 12, for the United States where as a University pensionado of the Philippine Government he will pursue advanced studies in tropical pomology and related subjects at the University of California. Later, he will spend about one year in familiarizing himself with the practices of commercial horticulture in the United States, West Indies, Central America, and Hawaii. Mr. Gonzalez is accompanied by his wife.

The following excerpts from a letter to Doctor Mendiola from Leonardo Salinas, B. Agr. '21, tell of his work with the government in British North Borneo:

. . . I wish to tell you something about my work in the Experiment Station which I began about two and a half years ago. I have cleaned-cleared and planted with different agronomic and horticultural crops for experimental purposes, sixty-one acres. I have written articles about these experiments which have been published in the *British North Borneo Herald*. Probably next year we will clear another sixty-one acres. . . . . .

We are carrying various experiments on the different crops which have at the present time or are likely to have a good market in Europe. We are also running tests on many kinds of forage crops, especially on native grasses and some imported ones as the Government is starting a dairy farm near Sandakan in which the cattle are to be fed with cultivated grasses. Some experiments have been conducted and some are in progress on the investigation of best cover crops to recommend to the rubber planters and coconut growers of B. N. Borneo. Our investigation on the improvement and importation of different fruit trees is becoming an interesting question among the Officers connected with administrative body of Government for on May 24 there will be an exhibition of fruit and vegetables in Sandakan Market under management of Government. . . . . .

We are also carrying on experiments on live stock farming. The Station has a pair of pure-breed Berkshire boars and eleven Native sows. We have started grading on hogs. We have Cantonese, Barred Plymouth Rock and Orpington fowls. We have also bullocks for pulling plows and sledges.

The remote Batu Lapan of about three years ago, the community of elephants, wild hogs, deer, and "Tombado" (wild cattle) is now a community of men. The road from Sandakan is now good for traffic for any vehicle. I have established a small village just outside the Station ground where my coolies live, some quarters for my foremen, overseer and my clerk. I will soon move to my new quarters I have just erected. I have built the house with first and second class timber I sawed from the felled logs in the Station. The house is 30 feet by 20 feet with a good sized kitchen behind it. In order to remedy the hardships of the coolies in buying food and other necessities I have had a "Kaday" put up in Batu Lapan by a Chinaman. Here all that is needed can be bought at low prices. Inside the Station I have built a Seedhouse with a concrete foundation and walled with planks.

In addition to our experimental work we are doing some ground improvement work. I am trying to beautify the Station grounds because most of the Sandakan people are becoming attracted to our place in their afternoon drives.

My working staff consists of a clerk, overseer, and foremen. I have very few coolies who are paid daily. I engage coolies by task work method. My experience as student laborer in the college helps me now very much in determining the amount of task work to assign to a coolie.

I still go on with my way of cooking my own food and when time permits I wash my clothes. So I am saving practically five-sixths of my monthly salary. True my place is very lonely, but I can save more money. I am raising plenty of chickens so that I do not need to buy my eggs and meat. . . . . .